joint clubbed, second conical, tip with "sensitive aciculi." Both joints equally long. *Mentum* fleshy, narrow at base, broadening toward the rounded tip. Apparently no *ligula*. *Head* small, yellowish with a small aspersion of black pigment on occiput.

The body-*integument* exhibits under the microscope a beautifully arranged black pigmentation with fine canals between them. *Legs*, the middle and posterior pairs slightly longer than the anterior. The coxal supports are prominent, coxæ short, trochanter very short and apparently connate with the former, but the cast-off skin plainly shows a ring of the former going over one of the latter, thus lacking the internode of the other articulations; femur and tibia with long thick bristles, both pieces compressed, the latter slightly shorter than the former; claw simple and with two spines at middle.

Prothorax gradually getting broader toward base, as long as two of any of the other segments together, an impression along the margin, the anterior transverse line of which reaches the middle of the segment.

Mesothorax a little wider than the preceding.

Metathorax, the widest of all the body-segments. About four times wider than long.

The abdominal segments gradually diminish in width toward pygidium. The three thoracic segments and the first eight abdominal segments with a short bristle at base of marginal scute and one such bristle at tip, the latter bent back and downward. Ninth dorsal segment at tip with a cylindrical, immovable spine of the length of any of the terzal scutes. *Spiracles*, nine pair; first and largest near base of prothorax a little behind and above the anterior coxa. Second to inclusive fifth spiracle in the pleurites anteriorly of each of the first five abdominal segments, the last three spiracles are much smaller and correspond with the sixth, seventh and eighth segments; ninth segment without spiracle.

First ventral abdominal segment and sternal region remain whitish with a slight darker aspersion between the coxæ. Tenth ventral segment prominent (anus), cylindrical, serving as a propeller, fimbriate around the margin.

Antennæ. Cylindrical, three-jointed. First joint narrow, conical at base, second slightly shorter than the preceding; near tip, interiorly with an "*olfactory disc*," consisting of two anterior larger and three posterior smaller areolæ. Third joint inserted into a fleshy, transparent, retractile internode, base of third joint very narrow, getting thicker and thickest a little behind middle, tip conical. Second and third joints with stronger bristles than first joint. Third joint bent *inwardly*.

The olfactory disc can be better seen in the exuviæ than in the living animal.

POTATO BUGS.—Last Monday there was such a swarm of potato bugs on the rails of the Connecticut River Railroad between South Ferry and Holyoke, Mass., that it was with difficulty the locomotive could draw the train through them. The crushed insects made the rails very slippery, causing the wheels of the engine to slide.—*Evening Star*, Washington, Sept. 13.

ON THE RED OR CIRCULAR SCALE OF THE ORANGE (Chrysomphalus ficus Riley MS.).

BY WM. H. ASHMEAD, JACKSONVILLE, FLA.

BIBLIOGRAPHICAL.

Chrysomphalus ficus Riley.	Manuscript notes.
" " "	Ashmead, *Fla. Agriculturist*, 1879.
" " "	Ashmead, *Pacific Rural Press*, 1880.

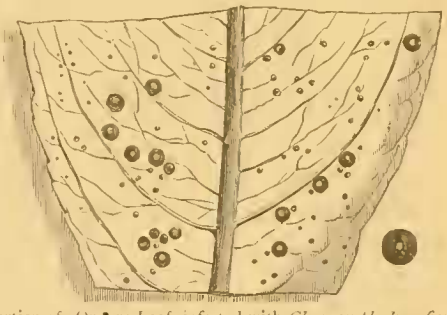
ITS FIRST APPEARANCE IN FLORIDA.

In September, 1879, I received the following communication, with specimens of infested leaves, from Mr. G. M. Holmes:

ORLANDO, Orange Co., Fla., Sept. 20, 1880.

Dear Sir:—Inclosed I hand you a leaf of an orange-tree infested with what appears to be a species of scale insect, which is new to us down here. It spreads from tree to tree very rapidly, and is not confined to the leaf, but appears upon tender stems and thorns. As you can see, it turns the leaf yellow wherever it locates itself.

[Fig. 146.]



Portion of Orange Leaf infested with *Chrysomphalus ficus* (after Ashmead).

I should like to know whether it is an enemy much to be dreaded, and, if you have had experience with it, the cure. Although a stranger to you, I see by the *Florida Agriculturist* that you have made the insects on orange-trees a study, and I thought you might give me some information about this particular insect. Yours, respectfully,—G. M. Holmes.

The scale being new to me, I immediately forwarded specimens to Prof. C. V. Riley, and from his reply I quote the following: "The circular, dark-brown scale with a golden centre has long been in my cabinet, and I have found it quite injurious to *Ficus nitida*. I have designated it by the manuscript name *Chrysomphalus ficus*, but have published no description of it, as the mere description of the scale without fully characterizing the insect that makes it, in both sexes, is imperfect entomological work."

ITS IMPORTATION AND SPREAD.

In Los Angeles, San Jose, California, and, indeed, in various parts of the State, it is quite numerous on the Orange, and is there known as the "Red Scale." The orange tree has but lately been introduced and grown in California, and this particular species is, therefore, not indigenous there. Where, therefore, did it come from, and how was it introduced into the State? These are two very important questions. Now, the commercial relations existing between the Californians with the people of China, Japan and Australia, point to one of these countries as its original home or starting point, from which it has spread. Indeed, many oranges have been imported from all these places, and it would not be surprising to me if, like our own *Long Scale* (*Aspidiotus Gloverii*), the Red Scale had been imported in the same manner, *i. e.*, on the leaves, branches or twigs of an imported tree. It has evidently been introduced into Florida this way.

ITS FOOD-PLANT.

Prof. Riley states that he first found it on the *Ficus nitida*; this, I presume, is an exotic species of Fig. I see by the *Pacific Rural Press*, that this, or an allied species, had been found on the Apple trees in San Jose, Cal. With the Orange, it attacks the fruit, leaves and twigs, seeming to like one about as well as another.

ITS NATURAL HISTORY.

I have not been able to thoroughly work up this insect, for want of specimens. From specimens received at different times, there would seem to be at least three broods, if not more, during the year. The first brood probably hatches in May; the second, from last of July to second week in August; and the third, from last of September to first week in October.

DESCRIPTIVE.

Eggs.—From 18 to 30 under each scale, less than .01 of an inch in length, ovoid, smooth, not quite twice as long as broad, of a bright yellow, promiscuously inclosed in body-walls of dead female.

Larva.—Length of body less than .01 of an inch, nearly twice as long as wide, *bright* yellow, ovoid, much wider towards head, being widest at thoracic segments; two very short anal setæ, hinder margin rough from numerous small fleshy tubercles, with a few short hairs around margin, no indentations as in *Ceroplastes rusci*; antennæ, 6-jointed (not easily made out with my microscope, which is of a low power); basal joint short and stout, nearly as wide as long; joints 2 and 3 less wide and of equal size; joints 4 and 5 about equal, each longer and thicker than 2 and 3 together; joint 6 much thinner, ending at tip in 2 long hairs, the inner being longest; an inner and outer hair on basal joint, with two inner and two outer ones on joints above these; legs ending in a feeble claw and four digituli, the two upper being longest; femora thickly swollen, with a distinct lobe near base, from which a sharp spine issues. I have never noticed this in any other scale insect.

Female Scale.—Form, round or circular, flattened slightly, rising towards centre, of from a reddish to a blackish-brown color, paler at margin, measuring from .04 to .12 of an inch in diameter; in the centre is a slight depression, in larger specimens .02 to .03 of an inch in diameter, and of a bright golden yellow, with a small brown cap.

REMEDY.

Mr. Holmes writes me, under date of August 6th, as follows: "As you request, I forward you by this mail a box containing specimens of the *Chrysomphalus ficus*, which I hope may reach you in good order. They have not done me any material damage as yet, but I keep my trees in very healthy condition and thrifty growth, as I have a large drove of cattle, and can cow-pen them. In my experiments for their removal, I have been most successful in the use of a strong brine of salt and water applied twice, at intervals of two weeks. It is heroic treatment and takes the leaves off, but the scale comes with them, and, if done just prior to a growing season, they soon send out a luxuriant new growth and

seem more healthy than before. I think if potash was mixed with salt and water it would be an improvement, and am going to use it that way. You have my best wishes for the success of your book on orange insects, which will supply a want or need long felt by intelligent orange-growers."

THE USE OF FUNGUS GROWTHS TO DESTROY INSECTS.

In the "American Naturalist" for August and September of the present year Prof. A. N. Prentiss of Cornell University, has an interesting contribution to the above-named subject. After reviewing the observations made by previous writers Prof. Prentiss makes the following remarks on the normal presence of fungus spores:

"In examining the question as proposed by Dr. Hagen, many facts must be taken into account before deciding upon the probable results. It must be remembered that the air is at all times charged with the spores of fungi. Dr. Cunningham found that 'spores and other vegetable cells are constantly present in atmospheric dust, and usually occur in considerable numbers; the majority of them are living and capable of growth and development.'"*

"Dr. S. M. Babcock, who is determining the chemical changes of cheese during the curing process, finds it impossible to avoid mold in the curd except by heat and anæsthetics (ether and chloroform). He states that the spores *seem* to be in the very milk used in the experiments.

"In the Botanical Laboratory, where molds and yeast are cultivated at certain times for experimentation, the air soon becomes charged with spores.

"Growing in the same laboratory and rooms directly connected with it, are plants which require constant care lest they be overrun with their several insect pests. No disease appears to have attacked these insects. It may be that they do not feed upon the yeast, and for this reason escape. It is not necessary that the spores be eaten by the insect in the case of the fly fungus (*Empusa muscæ*). Huxley says:* "It has been ascertained that when one of the spores falls on the body of a fly, it begins to germinate and sends out a process which bores its way through the fly's skin; this having reached the interior cavity of the body, gives off the minute floating corpuscles which are the earliest stages of Empusa. The disease is 'contagious,' because a healthy fly coming in contact with a diseased one from which the spore-bearing filaments protrude, is pretty sure to carry off a spore or two. It is 'infectious,' because the pores become scattered about all sorts of matter in the neighborhood of the slain flies."

"In this connection it should be noted that while the insects which infest more or less the plants growing in the laboratory have not been affected in any way by the fungi or their spores, the plants themselves, in some instances, have been seriously injured. On one occasion, recently, some experiments which had been commenced with much care upon *Drosera rotundifolia* were brought to a sudden end by a mold which completely overrun and destroyed the plant. That the air of the laboratory should become abundantly charged with spores, would, of course, be expected from the large number of experiments in the growth and propagation of microscopic fungi which at times are being conducted by the members of the classes in mycology. Indeed after a time the spores become so abundant that all apparatus has to become thoroughly cleansed and fumigation by sulphur resorted to in order that the experiments with the fungi themselves should not be defeated.

"The abundance of these spores of many kinds, including those of the house-fly fungus, emphasizes the fact that Aphides and other plant insects seem to thrive in the midst of these spores without any diminution of their vigor or power of reproduction."

A series of nine experiments in applying the yeast fungus to Aphides, as con-

* "Microscopical Examinations of Air," from the "Ninth Annual Report of the Sanitary Commissioner," Calcutta, 1872.

* "Lay Sermons, Addresses and Reviews," p. 372.